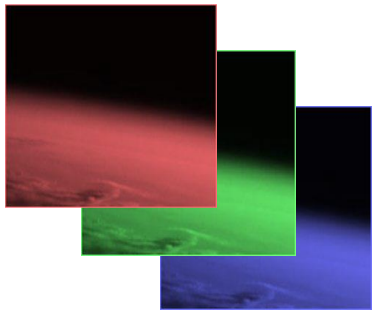
Earth Watch ALTIUS: Project Status

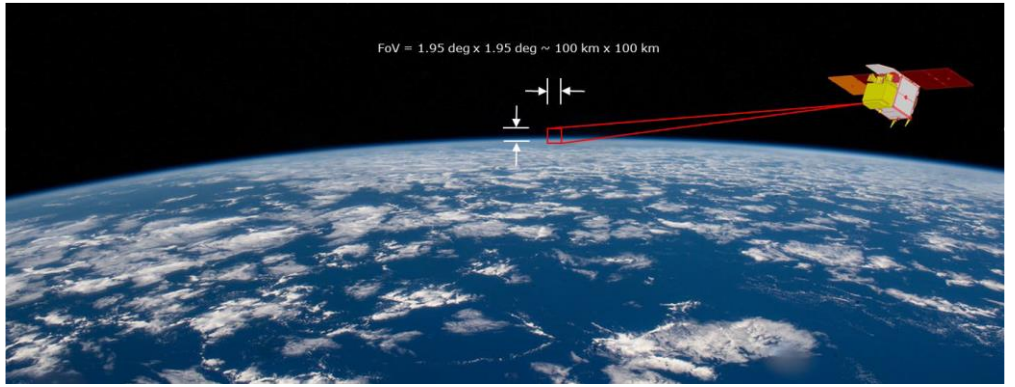
ALTIUS Project Team

Contents

ALTIUS: Mission Objectives – Observation Concept

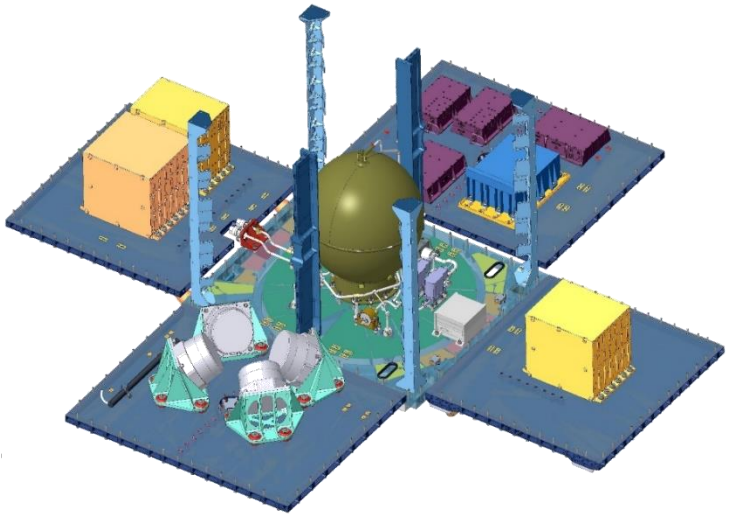
- **Limb sounder** mission for the monitoring of the distribution and evolution of stratospheric ozone at high vertical resolution
  - Primary products: NRT O_3 in support of operational services; consolidate O_3 for long term trend monitoring
  - Secondary products: Mesospheric O_3, aerosol extinction, NO2, H2O, OClO, BrO, NO3 and Temperature
- **Monochromatic 2-D snapshots (100 km x 100km)** taken by three separated cameras:
  - UV (250-355nm), VIS (400-675nm), and NIR (600-1020nm)
  - Snapshot wavelength tunable thanks to FPI (UV) and AOTF (VIS and NIR)
  - Field of View ~ 100 x 100 km at tangent point
- Observations contain several snapshots at different wavelengths
  - Bright Limb
  - Occultation: Sun, Moon, bright stars and planets
- Several imaging modes for spectral, radiometric and pointing **calibration**
- **Agile** satellite platform supporting these observations modes
- Mission lifetime is **3 years**, with potential extension to **5 years**
- **Launch in November 2026**

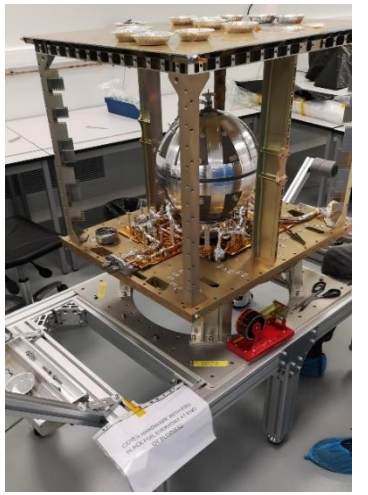


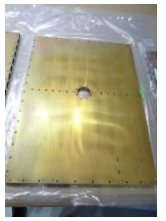


Satellite Platform Status

- Many Flight Items have been delivered to the Satellite Prime:
  - On-board computer, power conditioning and control unit, batteries, harness
  - Reaction wheels, magnetotorquers, propulsion system,
  - Antennae (X-band, S-band, GNSS)
- Other subsystems of the platform will be ready before end 2024:
  - Solar arrays
  - Mass-memory unit
  - X-band transmitter, S-band transceivers
  - GNSS receivers, star trackers
- Integration of the satellite platform has already started.
- Acceptance of Satellite Platform **beginning 2025**
- In storage, waiting for the instrument

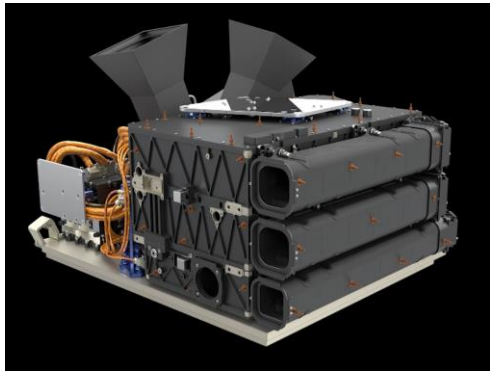
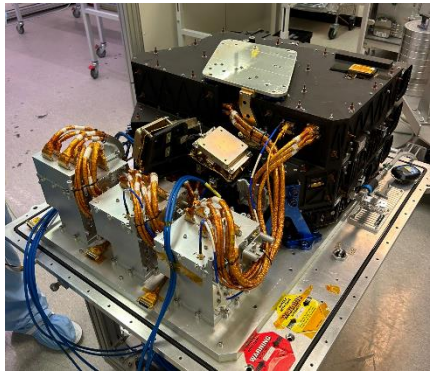
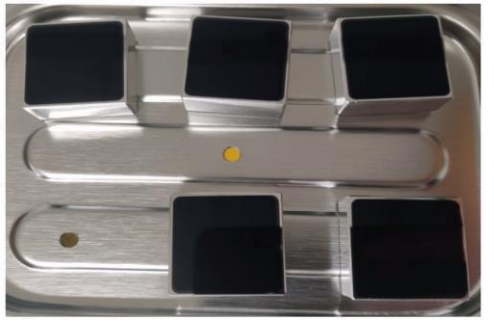


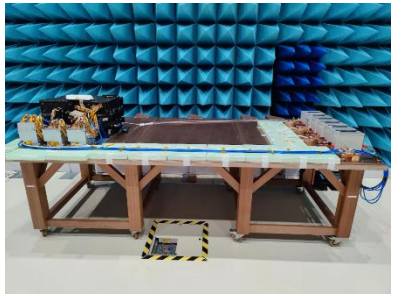
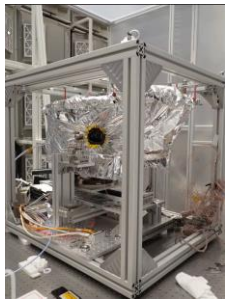
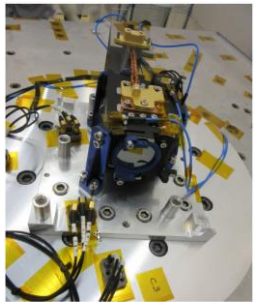




Instrument Status - Qualification

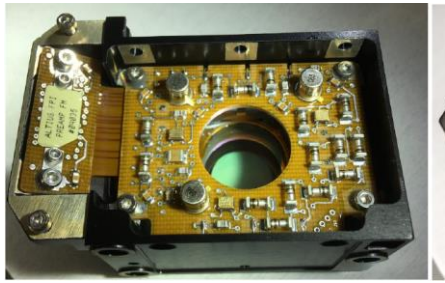
- Qualification on-going:
  - Some redesign identified for FPI, Focal plane and AOTF, as result of testing. Test successful with new enhanced design.
  - Front-end optics campaign identified problems with the assembly procedure. Test delta-campaign on-going, so far successful
  - UV mirror coating delamination problems. With enhanced cleaning procedure, problem is resolved. An alternative coating is also under qualification, to be used on mirrors with some thermal optical instability.
  - Electrical model functional and performance test successful. EMC completed at ESTEC.
  - Other tests to be completed
  - Full qualification campaign done by **September 2024**.

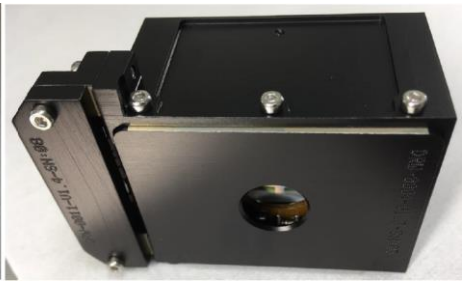




Instrument Status – Flight Hardware

- Many items already under manufacturing
  - FPI System
  - Mechanisms
  - UV Back-End Optics, and stand alone mirrors
  - VIS and NIR AOTF
  - VIS and NIR front-end and back-end optics
  - Optical benches
  - Baffles
  - Camera control units
- Some items on-hold awaiting end of qualifications
- Instrument integration Q4 2024
- Calibration planned for Q1 2026
- Integration with platform Q2 2026





Ground Segment Status

- Flight Operations Segment (FOS)
  - Development on-going, following on-board SW development.
  - FOS delivery expected in July
  - Small delay with Flight Dynamics System due to interfaces updates
- Payload Data Ground Segment (PDGS):
  - Finalized interface with the Satellite
    - Operations concept, including constraints
    - In-flight calibration commanding
  - Good progress with NO_2 and aerosol extinction profiles in occultation modes
  - V5 of L2 processing chain expected in September
- PDGS CDR
  - Kicked-off meeting 6 June
  - Running through the summer
  - Expected to be closed before end of the year

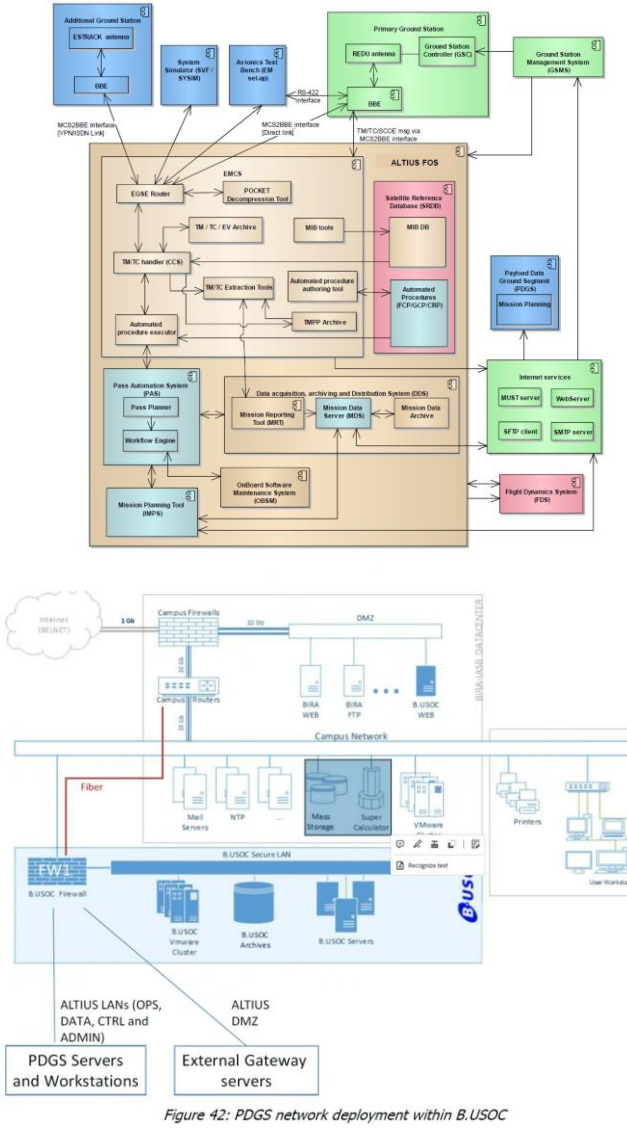
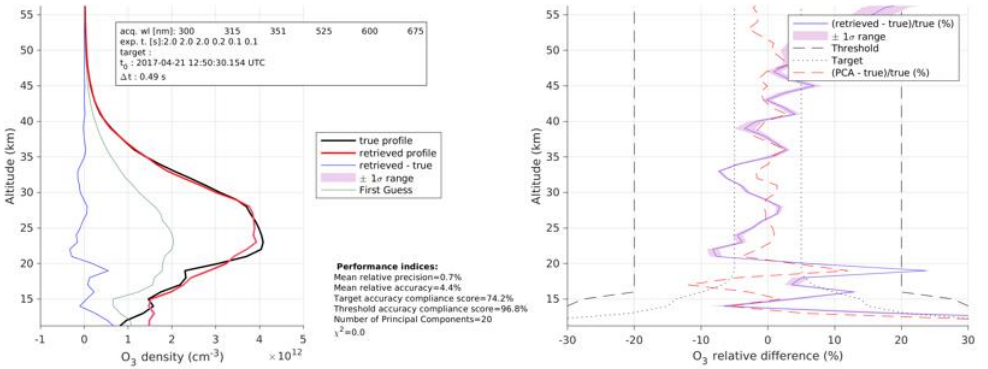


Figure 42: PDGS network deployment within B.USOC

Performance summary

- Performance L0/L1: Mostly marginal NC's that do not impact L2 compliance as shown at the E2E sim v4 DRB
- **Two NC's have major impact on the MRD**
  - **Number of stars** observable in stellar occupation
    - Not enough stars are observable (less than 2 per orbit instead of 5)
    - Limit the sampling on the night side of the orbit
    - Mitigation based on observing planets as well
  - **AOTF spectral inefficiencies**, as reported at CDR
    - Under assessment by BISA
    - Two mitigation approaches under study
      - corrective term: requires some research effort
      - use of the full spectrum together with AOTF leak information for better modelling the observations requires longer precomputation of look-up tables, e.g. more computer power



- Performance at L2: please stay tuned for the next presentations during this session !

Summary

- CDR running since last November
  - Issues under control. Closure expected on 11 July.
- Satellite Platform
  - Fully qualified. Flight model undergoing integration.
- Instrument
  - Qualification will finish in September 2024
  - Some flight model subsystem already manufactured and being integrated for acceptance
  - Most non-conformances have no apparent impact on mission product quality
    - Low number of stellar occultations, impacting sampling on the night side
    - AOTF Spectral rejection inefficiencies, not a mission killer, mitigation measure on-going

In addition…

- CALVAL AO Call will be published in **September 2024** => See oral presentation at the end of this session.
- Launch expected in **November 2026**, pending availability and manifest of Vega-C

Some other ALTIUS presentations in this session…

- *The ALTIUS Stratospheric Aerosol Data Product,*
  - by Doug Degenstein (University of Saskatchewan)
- *ALTIUS O3 retrieval algorithms and expected in-flight performance,*
  - by Emmanuel Dekemper (BIRA-IASB)
- *Altius In-flight Calibration Activities,*
  - by Nicholas Lloyd (University of Saskatchewan)
- *Direct methods for the inversion of limb scattering measurements by machine learning techniques,*
  - by Didier Fussen (BIRA-IASB)
- *ALTIUS: Call for Announcement of Opportunity for participation in the calibration/validation,*
  - by Claus Zehner (ESA/ESRIN)

And some more posters by BIRA-IASB

Questions?